OBSERVATIONS ON SEMI-DESERT ANTS.

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I. Early Spring Temperatures of Ant Mounds in the Sagebrush Semi-Desert.

The two most prominent ant mounds in the sagebrush semi-desert area of southern Idaho are those of *Pogonomyrmex occidentalis* Cresson and *Formica rufa obscuripes* Forel. They occur in great abundance at Twin Falls, Idaho, those of the former scattered and those of the latter grouped. The collection of temperature data was begun on March 21, the first calendar day of spring.

In early spring the interiors of mounds of *P. occidentalis* are only slightly warmer than the exteriors. This is particularly true of mounds composed entirely of pebbles which do not tend to absorb heat as rapidly as do those of detritus. Temperature varies with depth, being higher toward the surface of the mound and lower with descending progression. The highest temperatures occurred at a depth of approximately four inches and the lowest at eighteen. Temperatures at various depths in an average sample of each type of mound are shown in Table I and Figure 1. The air temperature at the time of these measurements (2 p. m.) registered 40 degrees Fahrenheit. Note the gradual decrease in temperature at increasing depths below four inches. This partly accounts for the fact that in early spring the majority of ants of this species are situated at the optimum temperature level of about four inches.

Formica obscuripes is the first ant to become active in the early spring in the vicinity of Twin Falls. It builds dome-shaped mounds of sticks and leaves which are generally formed around large plants of sagebrush (5). Figure 2 illustrates typical mound temperatures on March 31, 1932. Note the contrast between temperatures within the mounds and those of adjacent soil. The highest mound temperature obtained was 80 degrees Fahrenheit and occurred six inches below the mound surface. There was a decided drop in temperature

between the six and the two inch level. The temperature of adjacent soil, on the other hand, was slightly higher at two than at six inches and there was a marked increase from the two-inch level to the soil surface. At the time these temperatures were recorded (11 a. m.) the air temperature in the shade registered 68 degrees Fahrenheit and 70 degrees in the sun. The surface temperature of the shady face of the mound was recorded as 80 degrees and that of the sunny face as 94 degrees.

TABLE I.

Typical Early Spring Temperatures of Mounds of *Pogonomyrmex occidentalis* at Various Depths.

Depth	Temperature Pebble Mound	Temperature Detritus Mound
0 inches	36.5 F.	36.5 F.
2	37.0	37.8
4	38.0	39.5
6	37.5	38.2
8	36.0	36.4
10	36.0	36.0
12	35.3	35.4
14	33.6	33.1
16	32.2	32.2
18	32.0	32.1
20	32.1	32.2

The faces of mounds of both species attain higher temperatures than does the adjacent soil surface because the rays of the sun on the faces are more intense than on a like area of soil surface. This point is diagrammatically illustrated in Figure 3. Only when the sun is directly overhead are its rays, directed upon both the mound and adjacent soil, of equal intensity. During the greater part of the day one face of the mound tends to lie more or less perpendicular to the sun's rays, while the rays are more dispersed on the level soil adjoining the mound.

LITERATURE.

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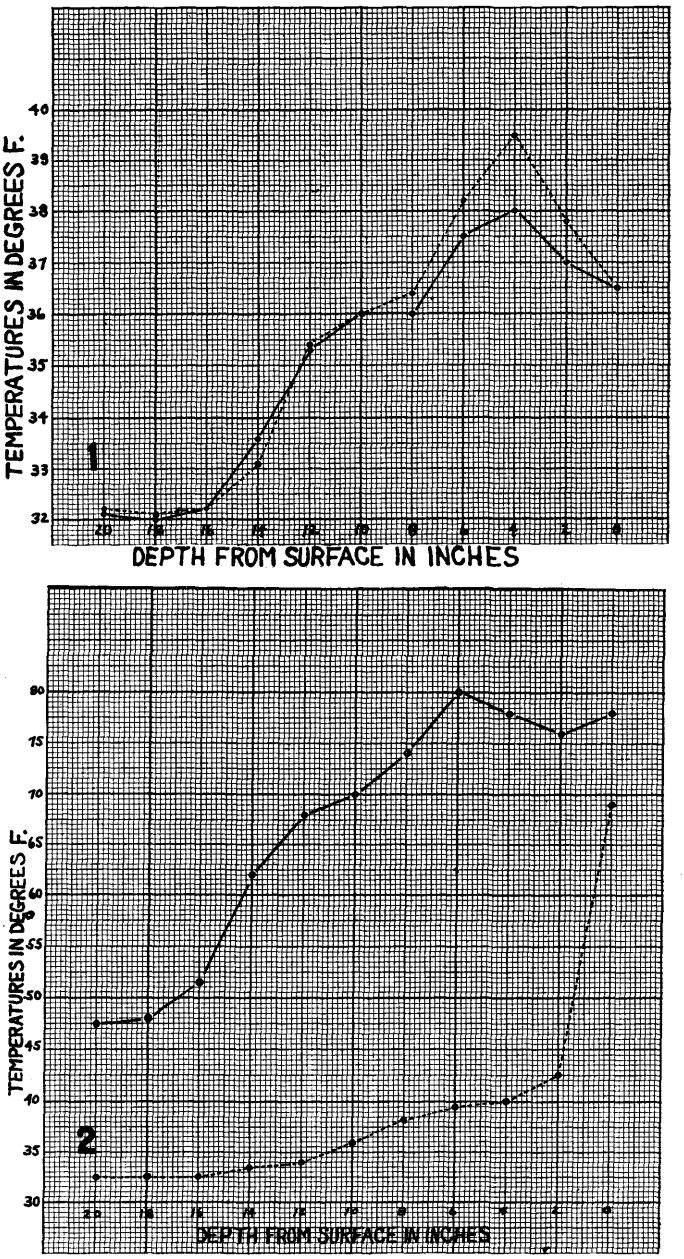


FIG. 1. Typical early spring temperatures, at various depths, in mounds of *Pogonomyrmex occidentalis*. The solid line represents temperatures of a pebble mound and the broken line those of a mound of detritus.

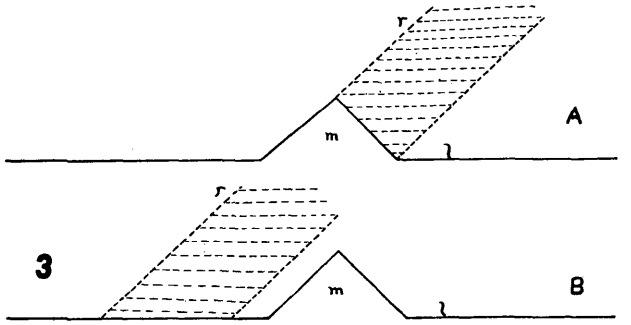
FIG. 2. Typical early spring temperatures of a mound of *Formica rufa obscuripes* and an area of adjacent soil. The solid line represents temperatures of the mound and the broken line those of the adjacent soil.

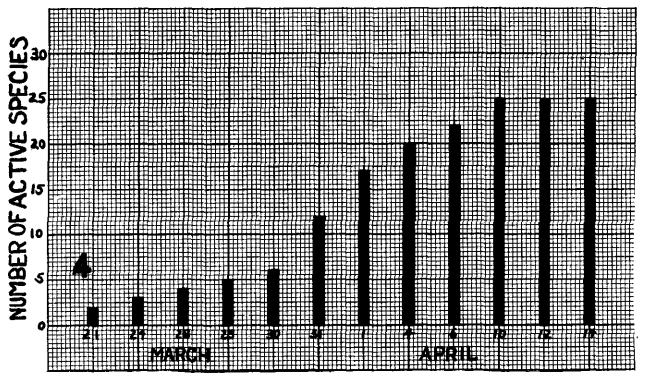
II. Increase in Early Spring Activity of Semi-Desert Ants.

Observations on the increase in the number of species of ants becoming active from the first calendar day of spring to the middle of April, 1932, were made by the writer in the Twin Falls Area, Idaho.

On March 21 two species of ants were decidedly active in this section, namely, *Formica rufa obscuripes* Forel and *Tapinoma sessile* Say. The temperatures within the detritus mounds of *F. obscuripes* were much higher than the prevailing atmospheric temperatures, (Part I of this paper; also reference (3)). *Tapinoma sessile*, on the other hand, is one of our most hardy ants and is quite active even under low temperature conditions. On March 24 the Occident Ant (*Pogonomyrmex occidentalis* Cresson) began activity and removed the grass coverings from its pebble mounds. March 28 marked the initial date of early activity of *Lasius niger americanus* Emery; March 29, of *Formica subpolita* Mayr; March 30, of *Formica fusca subsericea* Say; March 31, of *Lasius umbratus mixtus aphidicola* Walsh., *Formica neogagates neogagates* Emery, *Camponotus hyatti* Emery, *Leptothorax curvispinosus rugatulus* Emery, *Crematogaster lineolata* Say, and *Monomorium minimum* Buckley; April 1, of *Formica sanguinea puberula* Emery, *F. cinerea neocinerea* Whlr., *Solenopsis molesta validuiscula* Emery, *Myrmica rubra scabrinodis* Nyl., and *Myrmecocystus melliger semirufus* Emery; April 4, of *Leptothorax melanderi* Whlr., *Iridomyrmex pruinosus* var., and *Myrmica sp.;* April 6, of *Myrmica mutica* Emery and *Brachymyrmex sp.;* and April 10, of *Pheidole sp.*, *P. vinlandica longula* Emery, and *Lasius niger sitkaensis* Pergande. Figure 4 shows the increasing number of active species from March 21 to April 10, 1932.

The first to venture forth from their winter quarters were those species which occupied deep canyons. In such habitats the average temperatures were somewhat higher than on the semi-desert plains. Those species whose nests were on south- and east-facing hillsides were the next to exhibit signs of activity, this again being a temperature relationship. Next appeared those species in areas of shrubby vegetation, and then those whose nests were on the dark-colored sand plains, where the surface tended to absorb a large part of the sun's rays. Last to make their appearance were those species on





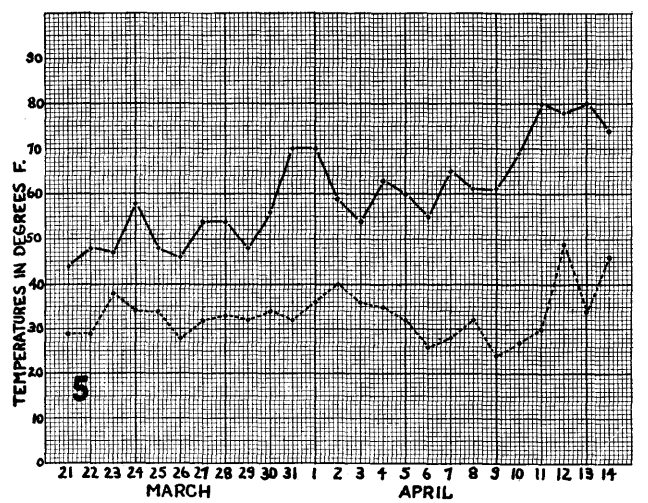


FIG. 3. Diagrammatic representation of the angle of contact of the rays of the sun. (A), rays directed against the face of a mound of *Formica obscuripes*, and (B), those directed on an area of adjoining soil surface. m, mound; r, rays of sun; l, ground level.

FIG. 4. Active species of ants at different dates.

FIG. 5. Gradual increase of daily temperature.

the lighter-colored sand plains, where much of the heat was radiated and where the soil temperatures were not so high as on the darker sands. Thus we have a gradational series of active species in a variety of habitats, from the latter part of March to the warmer days of mid-April.

The increasing early spring activity of semi-desert ants can be explained on the basis of increasing maximum and minimum daily temperatures. So closely is temperature connected with a complexity of other factors that we cannot separate it from the others, but merely place it as dominant in this particular case. Note the gradual increase of daily temperatures in Figure 5. In spite of major and minor fluctuations the increase is rather well marked, especially in the case of the maximum temperature curve. The high maximums between March 30 and April 1 ushered in eleven kinds of ants, the greatest number of additional species appearing at any one time. The most sun-loving ant of the series, *Myrmecocystus melliger semirufus*, appeared on April 1 at a maximum temperature level of 70 degrees Fahrenheit. In spite of the high maximum temperatures on days following April 10, no additional species were observed in an active condition (Figure 4).

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